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Senior School Certificate Examination

March 2015

Marking Scheme - Biology (Theory)

Expected Answers/Value Points

General Instructions :

The Marking Scheme and mechanics of marking

1. In the marking scheme the marking points are separated by commas, one oblique line (/) indicates acceptable alternative, two obliques (//) indicate complete acceptable alternative set of marking points.
2. Any words/phrases given within brackets do not have marks.
3. Allow spelling mistakes unless the misspelt word has another biological meaning. Ignore plurals unless otherwise stated in the marking scheme.
4. In any question exclusively on diagram no marks on any description. But in questions on descriptions, same value points may be marked on the diagrams as a substitute.
5. All awarded marks are to be written in the left hand margin at the end of the question or its part.
6. Place a tick (✓) in red directly on the key/operative term or idea provided it is in correct context. Place “Half-tick” ½ wherever there is ½ mark in the marking scheme. (Do not place tick indiscriminately just to show that you have read the answer).
7. If no marks are awarded to any part or question put a cross (×) at incorrect value portion and mark it zero (in words only).
8. Add up ticks or the half ticks for a part of the question, do the calculation if any, and write the part total or the question total in the left hand margin.
9. Add part totals of the question and write the question total at the end. Count all the ticks for the entire question as a recheck and draw a circle around the question total to confirm correct addition.
10. If parts have been attempted at different places do the totalling at the end of the part attempted last.
11. If any extra part is attempted or any question is reattempted, score out the last one and write “extra”.
12. In questions where only a certain number of items are asked evaluate only that many numbers in sequence as is asked ignoring all the extra ones even if otherwise correct.
13. Transcribe the marks on the cover page. Add up question totals. Recheck the script total by adding up circled marks in the script.
14. Points/answer given in brackets in marking scheme are not so important and may be ignored for marking.

Question Paper Code 57 (B)

(FOR BLIND CANDIDATES ONLY)

SECTION A

Q. Nos. 1 - 5 are of one mark each

1. **Why do internodal segments of sugarcane fail to propagate vegetatively even when in contact with damp soil ?**

Ans. Due to absence of meristem / buds in internodal region

[1 Mark]

2. **Mention any two Mendelian recessive disorders in humans.**

Ans. Haemophilia / colour blindness / cystic fibrosis / Thalassemia / sickle cell anaemia / phenylketonuria (any two) = $\frac{1}{2} + \frac{1}{2}$

[1 Mark]

3. **Why is DNA replication termed as semi-conservative ?**

Ans. After replication each DNA contains one parental strand and one newly synthesized strand = $\frac{1}{2} + \frac{1}{2}$ (one strand of previous generation conserved)

[1 Mark]

4. **Name the virus which causes one of the most common human ailments - the common cold.**

Ans. Rhino virus

[1 Mark]

5. **Mention the role of 'Ori' in a cloning vector.**

Ans. Replication of (linked) DNA starts at 'Ori', controls the copy number of DNA = $\frac{1}{2} + \frac{1}{2}$

[1 Mark]

SECTION B

Q Nos. 6 - 10 are of two marks each

6. **How does CuT act as a contraceptive ?**

Ans. CuT releases Cu-ions which suppress sperm motility, fertilizing capacity of sperm = 1 + 1

[2 Marks]

OR

Mention the changes the zygote of fungi undergo before they develop into new individuals. Why do these changes take place ?

Ans. Zygote develops a thick (resistant) wall = 1

These changes take place to avoid desiccation, damage = $\frac{1}{2} + \frac{1}{2}$

[2 Marks]

7. Mention the pattern of inheritance of human skin colour. How does it deviate from that of Mendelian pattern of inheritance ?

Ans. Polygenic (quantitative) inheritance / controlled by multiple (many) genes = 1

Skin colour does not show distinct alternate forms / spreads across a gradient (unlike Mendelian trait) / effect of each allele is additive = 1

[2 Marks]

8. List any four characters that the plant breeders have tried to incorporate into crop plants so as to increase the crop yield.

Ans. Improved quality, increased tolerance to environmental stresses (heat / salinity / drought), resistance to pathogens (virus, fungi, bacteria), increased tolerance to pests = $\frac{1}{2} \times 4$

[2 Marks]

9. Name the bioactive molecule that is used as immuno-suppressive agent and its source organism.

Ans. Cyclosporin A, Trichoderma polysporum = 1 + 1

[2 Marks]

10. Name and explain the association that exists between egret and the cattle.

Ans. Commensalism = 1

The egret is benefitted (by getting insects as food flushed out from the vegetation which gets stirred up due to grazing by cattle), cattle is neither harmed nor benefitted = $\frac{1}{2} + \frac{1}{2}$

[2 Marks]

SECTION C

Q Nos. 11 -22 are of three marks each

11. How is parthenogenesis different from parthenocarpy? Mention one example of each.

Ans. Parthenogenesis is the development of new organism by female gamete without fertilization = 1

eg. male honeybee / drones / lizards / rotifers / turkey (any one) = $\frac{1}{2}$

Parthenocarpy is development of fruit without fertilization = 1

eg. Banana = $\frac{1}{2}$

[3 Marks]

12. State the function of placenta in humans. List the hormones secreted by it.

Ans. Facilitates supply of oxygen / nutrients to the embryo, removal of CO_2 / excretory / waste material produced by the embryo = $\frac{1}{2} + \frac{1}{2}$

Hormones - hCG (human chorionic gonadotrophin), hPL (human placental lactogen), estrogen, progesterone = $\frac{1}{2} \times 4$

[3 Marks]

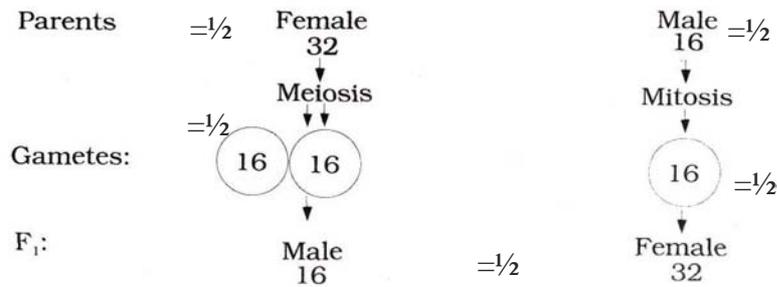
13. Explain the mechanism of sex-determination in honeybees. What is it called ?

Female honeybee (32 chromosomes) are diploid, produce haploid gametes / eggs (16 chromosomes) through meiosis, Males are haploid (16 chromosomes) / produce haploid gamete through mitosis,

Males develop from unfertilized eggs through Parthenogenesis , Females develop from fertilized egg (formed by union of egg and sperm) = $\frac{1}{2} \times 5$

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(Same weightage for the graphic representation)



This is known as haplodiploid sex determination system = $\frac{1}{2}$

[3 Marks]

OR

Explain pleiotropy with the help of an example.

Ans. Single gene exhibiting multiple phenotypic expression is called Pleiotropy , = 1

Example - phenylketonuria = $\frac{1}{2}$

Occurs due to mutation of a single gene (coding for phenyl alanine hydroxylase) = $\frac{1}{2}$

Leads to multiple phenotypic expression mental retardation / reduction in hair / skin pigmentation (any two) = $\frac{1}{2} + \frac{1}{2}$

[3 Marks]

14. Name the different types of RNA along with their functions, that take part in the process of translation.

Ans. mRNA / messenger RNA , determines the order and sequence of amino acid in the polypeptide chain and provides the template = $\frac{1}{2} + \frac{1}{2}$

tRNA / transfer RNA , Reads the genetic code and brings the amino acids = $\frac{1}{2} + \frac{1}{2}$

rRNA / ribosomal RNA , forms the structure of ribosomes and catalyses peptide bond formation = $\frac{1}{2} + \frac{1}{2}$

[3 Marks]

15. Study the following traits observed in a human suffering from a genetic disorder :

Short statured, small round head, furrowed tongue and partially open mouth.

Identify this genetic disorder and mention its cause. Write two more characteristics of this disorder.

Ans. Down's syndrome = 1

Due to presence of an additional copy of chromosomes no 21/ trisomy of 21st Chromosome = 1
 Broad Palm with characteristics palm creases / congenital heart disease / many 'loops' on finger tips
 / mental / psychomotor development is retarded (any two) = $\frac{1}{2} + \frac{1}{2}$

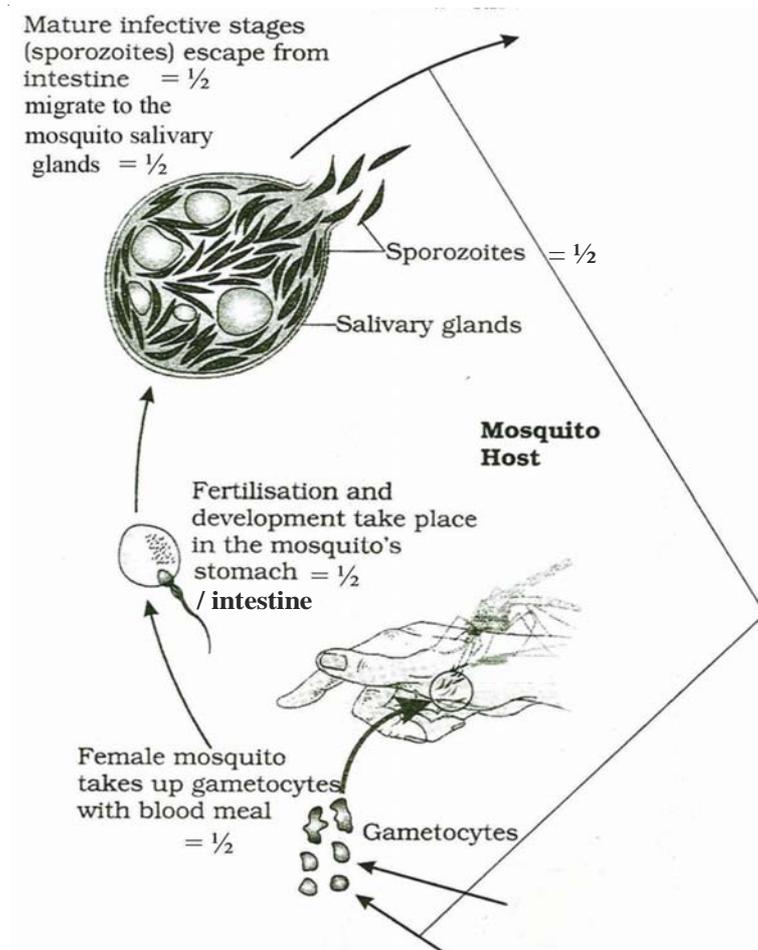
[3 Marks]

16. Trace the stages in the life cycle of Plasmodium that takes place in the mosquito. Write the scientific name of the protozoan which causes malignant malaria.

Ans. Female anopheles mosquito if bites the infected human being takes up the gametocytes with the blood meal, fertilization of male & female gametocytes and development takes place inside the mosquito's intestine, mature infective stages (sporozoites) escape from intestine, migrate to the salivary gland, sporozoites are now ready to be injected into the body of another human being = $\frac{1}{2} \times 5$

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same weightage to the diagrammatic representation.



Plasmodium falciparum = 1

[3 Marks]

17. Explain the primary and secondary immune responses produced by our body. Name the type of antibody

- (i) present in the colostrum of mother, and
- (ii) that is produced in response to an allergen.

Ans. Primary response is a low intensity response shown by the body when it encounters the pathogen for the first time = 1

Secondary response is a high intensity response with repeated (subsequent) exposure to the same pathogen = 1

- (i) Ig A = 1/2
- (ii) Ig E = 1/2

[3 Marks]

18. Write the three common approaches for the treatment of cancer. How are they administered on a patient ?

Ans. Common approaches for the treatment of cancer are :-

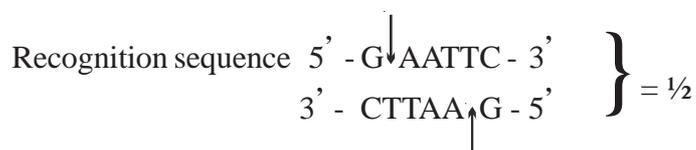
- (i) Surgery or removal of the Cancerous part / tumor from the body = 1
- (ii) Radiation Therapy , Tumor cells are irradiated lethally (taking proper care of surrounding normal tissue) = 1/2 + 1/2
- (iii) Immuno Therapy (Chemotherapy) , Chemo-therapeutic drugs are used to kill the cancerous cells = 1/2 + 1/2

[3 Marks]

19. How does a restriction endonuclease function ? Name a restriction endonuclease and write the specific sequence of bases that it recognizes.

Ans. Restriction endonuclease inspects the length of the DNA sequence, binds to the specific recognition sequence / palindromic sequence, cuts the strand of DNA at specific point in the sugar phosphate bond (a little away from the centre), between the same two bases on the opposite strands leaving single stranded overhanging stretches called sticky ends = 1/2 × 4

Restriction Endonuclease = EcoRI = 1/2



[3 Marks]

20. How did Eli Lilly, using rDNA technique, make it possible to treat diabetic patients with human insulin ?

Ans. Mature human insulin consists of two short polypeptide chains A & B, Eli Lilly prepared two DNA sequences corresponding to chain A & B, introduced them in the plasmids of *E. coli* (to produce insulin chains), chains A & B were produced separately, extracted and combined, by creating disulphide bonds to form human insulin = 1/2 × 6 = 3

[3 Marks]

21. Biotechnology has played an important role in developing boll worm resistant cotton plants. Explain how such cotton plants are developed and made resistant to boll worm.

Ans. Some strains of *Bacillus thuringiensis*, produce insecticidal proteins that kill bollworm, this protein is encoded by cry gene II Ab / cry I Ac , this gene was isolated from the bacteria (*Bacillus thuringiensis*), incorporated into cotton plant, thus making the plant resistant to bollworm = $\frac{1}{2} \times 6$

[3 Marks]

22. Name and explain the naturally occurring phenomenon responsible for heating of Earth's surface and its atmosphere. State how this phenomenon is responsible for global warming.

Ans. Green House effect = $\frac{1}{2}$

Half of the solar radiations entering the earth helps in heating it , the surface re-emits heat in the form of infra red radiation , part of this heat does not escape (into the space) and gets absorbed by green house gases CH₄ / methane and CO₂ / carbon dioxide , these gases radiate the heat back to the earth keeping it warm = $\frac{1}{2} \times 4$

Increase in the level of green house gases has led to considerable heating of the earth thus causing global warming = $\frac{1}{2}$

[3 Marks]

SECTION D

Q No. 23 is of four marks

23. Indiscriminate human activities are one of the major reasons in causing imbalance in the environment. You, as a member of an eco-club of your school, are participating in "Save your environment" programme, organized by the cluster-schools in your neighbourhood. Why is there a dire need to organize such programmes ? List any three activities that you would suggest and plan to organize for this programme. Give reasons for each one of the activities.

Ans. We need to organise such programmes as indiscriminate human activities are affecting the environment adversely and causing threat to the survival of the man and other living beings / indiscriminate use of resources is leading to destruction of the environment / to maintain sustainable utilization of bio resources / judicious use of natural resources (or any other appropriate reason) = 1

Activities -

- (i) Plantation drive - to purify the environment / maintaining hydrological cycles / preventing soil erosion / maintain temperature or any other
- (ii) 'Say no to plastic' campaign - To reduce the use of non-biodegradable substances and promote the use of biodegradable substances
- (iii) Segregation of wastes - To segregate the garbage produced in the school into biodegradable , non biodegradable and recyclable components
- (iv) Judicious use - of water, electricity , paper etc. to conserve the natural resources

Or any other relevant activity (any three) 1×3

[4 Marks]

SECTION E

Q Nos. 24 -26 are of five marks each

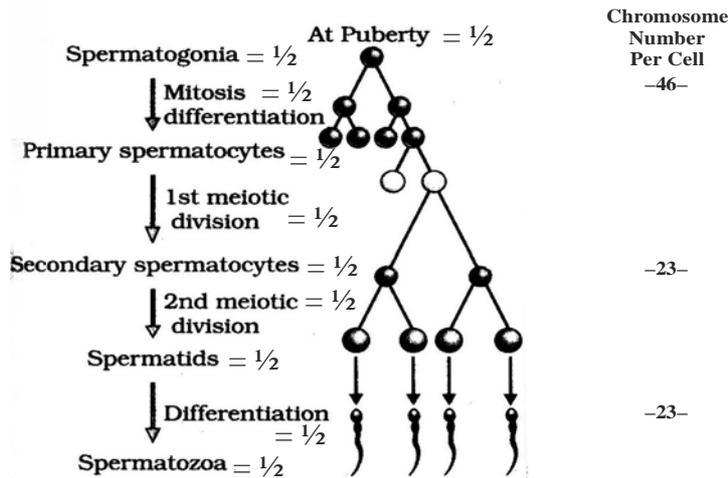
24. (a) **Self-pollination ensures seed formation yet cross pollination is preferred. Explain giving reasons.**
- (b) **Explain any three outbreeding devices adopted by flowers in angiosperms.**
- Ans. (a) Cross pollination is preferred as it adds new characteristics, creates genetic variations, leads to the formation of improved varieties, prevents inbreeding depression (any two) = 1 + 1
- (b) Outbreeding devices :-
- (i) Pollen release and stigma receptivity of the same flower is not synchronized - (takes place at different time)
 - (ii) Anther and stigma are placed at different positions - so that pollens do not come in contact with stigma of the same flower
 - (iii) Self - incompatibility - pollen from the same flower do not germinate on the pistil of the same or other flowers of the same plant
 - (iv) Production of unisexual flowers - It prevents autogamy (in monoecious plants) but not Geitonogamy

(Any three) = 1 + 1 + 1

[5 Marks]

OR

Explain the process of spermatogenesis in humans.



Spermatogenesis

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At puberty, spermatogonia (present in the seminiferous tubules), multiply by mitotic division, to

produce diploid primary spermatocyte, which undergoes first meiotic division , to form two haploid secondary spermatocytes , these further undergo second meiotic division , to produce four equal haploid spermatids , which are transformed or differentiated (spermiogenesis) , into spermatozoa
 $= \frac{1}{2} \times 10$

[5 Marks]

25. Explain the salient features of double-helix DNA strand.

- Ans. (i) DNA is made of two complementary polynucleotide chains
- (ii) Each nucleotide contains a nitrogenous base (Adenine, Guanine, Cytosine, Thymine) linked with de-oxynbose sugar (by glycosidic linkage) which is attached to phosphate group by (phosphoester bond)
- (iii) Two chains have antiparallel polarity (i.e one has 5' -3' polarity and other has 3' -5' polarity)
- (iv) The bases in the strands are paired through hydrogen bonds forming base pairs
- (v) Adenine pairs with Thymine with double hydrogen bond and Cytosine pairs with Guanine with triple hydrogen bonds and vice-versa.
- (vi) Both the chains are coiled in a right handed fashion
- (vii) The pitch of helix is 3.4 nm.
- (viii) There are 10 base pairs in each turn
- (ix) The distance between a base pair in the helix is 0.34nm.
- (x) The plane of one base pair stacks over the other in a double helix $= \frac{1}{2} \times 10$

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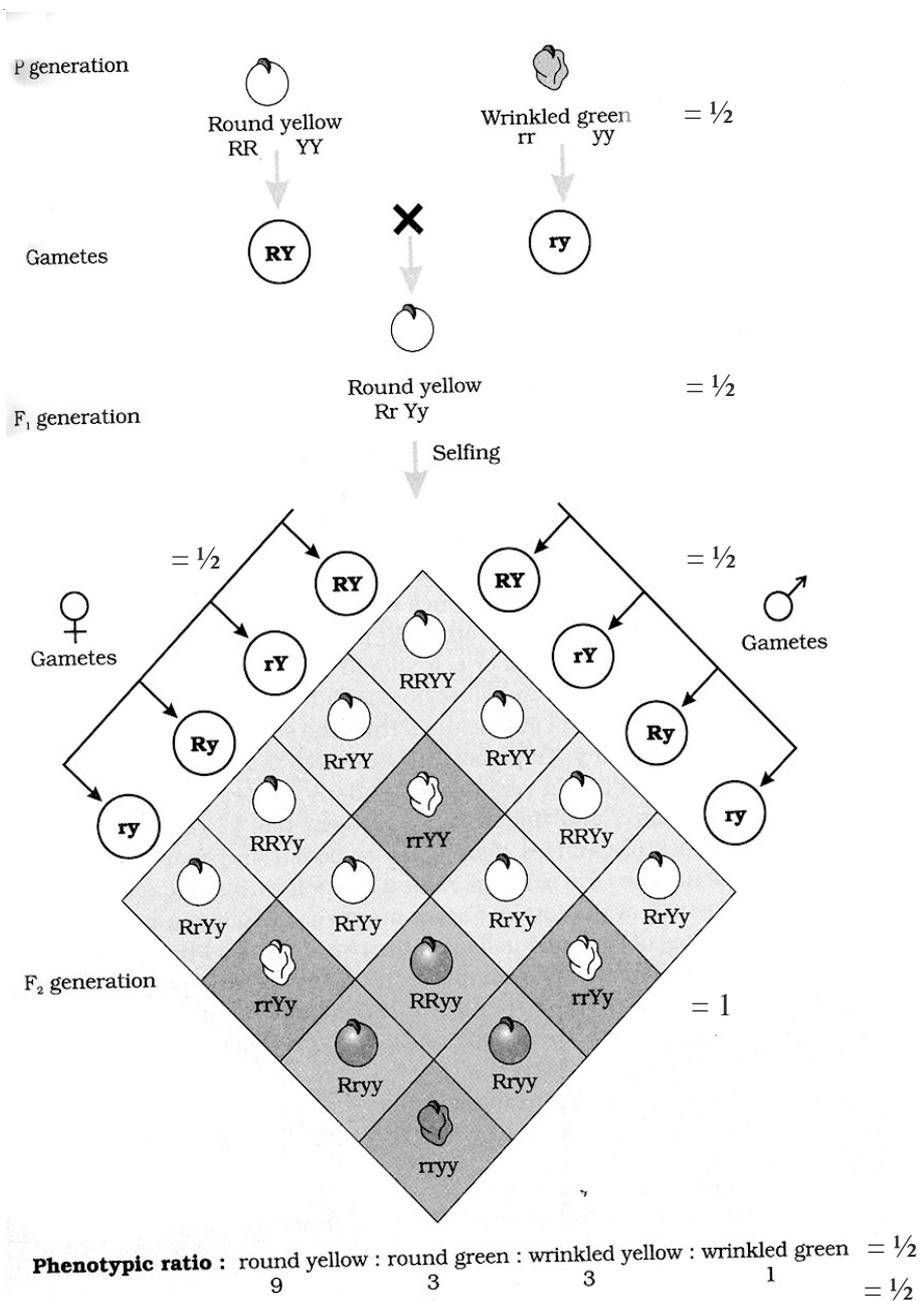
Diagram of DNA helix depicting all the above ten value points

[5 Marks]

OR

Work out a typical Mendelian dihybrid cross and explain how Mendel derived the Law of Independent Assortment from such a cross.

Ans.



Inference- In a dihybrid cross two pairs of traits (round and yellow seeds and wrinkled and green seeds) when combined in a hybrid, segregated from each other in an independent manner get assorted in offsprings (appearance of new combinations of yellow wrinkled seeds and green round seeds) = 1

[5 Marks]

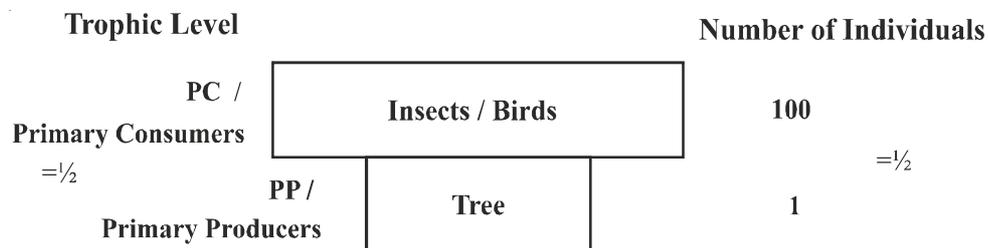
26. (a) Explain an ecological pyramid of numbers.
 (b) Pyramids are mostly upright, but sometimes exceptions do occur. Why? Explain with the help of an example.

Ans. (a) Ecological pyramids of number is a diagrammatic representation showing relationship between organisms at different trophic levels in terms of their number = 1

The pyramid of number which is usually upright has a broader base representing larger number of primary producers, narrows down at the apex as the number of organisms at each trophic level decreases = $\frac{1}{2} + \frac{1}{2}$

(b) Exceptions : (Inverted pyramid)

- (i) Pyramid of number, at a given time many birds / insects (primary consumers) feeding on single big tree (primary producer) = $\frac{1}{2} + 1$

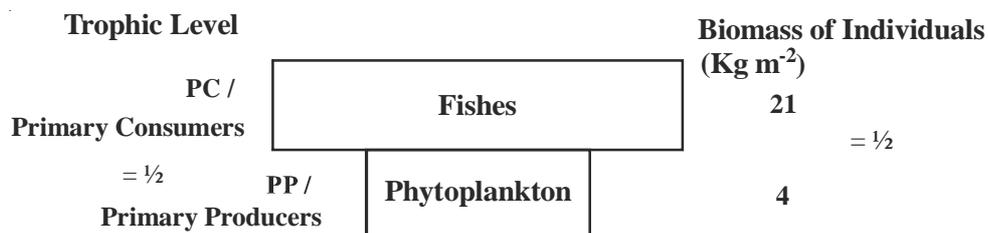


(For Correct Diagram) = $\frac{1}{2}$

= $\frac{1}{2} \times 3$

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- (i) Pyramid of biomass, at a given time in the sea the biomass of fish / zooplankton (primary consumers) is more than that of phytoplanktons (primary producers) = $\frac{1}{2} + 1$



For correct Diagram = $\frac{1}{2}$

= $\frac{1}{2} \times 3$

[5 Marks]

OR

You have read about Ahmed Khan, a plastic sack manufacturer and of his innovative idea of plastic waste management. Describe his effort and of the people who joined him and how they were benefitted.

- Ans. (i) Ahmed Khan developed polyblend , a fine powder of recycled modified plastic film waste
- (ii) This mixture was mixed with bitumen that is used to lay roads
- (iii) R.V. College of Engineering and Bangalore City Corporation joined him and found that combination of polyblend and bitumen enhanced bitumen's water repellent properties and helped to increase the road life
- (iv) More than 40 km of road has been laid with this polyblend
- (v) Ahmed Khan helped the rag pickers by giving them better price for plastic film waste (Rs. 6.0 instead of Rs. 0.40 per kg)

= 1 × 5

[5 Marks]